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## REMARKS

By this amendment, claims 1, 2, 5-11 and 29-45 are pending in the application; of which claims 1, 5 and 7 are being amended and claims 29 to 45 are being added. Claims 12-28 are canceled.

The added claims 29-45 are supported by the original claims and the Specification at page 10, line 3 to page 11, line 5. Thus, the claims add no new matter, and entry of the claims is respectfully requested.

**Rejection under 35 U.S.C. § 103**

1. The Examiner rejected claims 1-4, 6 and 9-10 under 35 U.S.C. § 103(a) as being unpatentable over Sasaki et al. (U.S. Patent No. 6,214,130) in view of Braton et al. (U.S. Patent No. 3,934,379).

To establish a *prima facie* case of obviousness under 35 U.S.C. 103:

(A) The claimed invention must be considered as a whole;

(B) The references must be considered as a whole and must suggest the desirability and thus the obviousness of making the combination;

(C) The references must be viewed without the benefit of impermissible hindsight vision afforded by the claimed invention; and

(D) Reasonable expectation of success is the standard with which obviousness is determined.

Hodosh v. Block Drug Co., Inc., 786 F.2d 1136, 1143 n.5, 229 USPQ 182, 187 n.5 (Fed. Cir. 1986). A determination of obviousness requires that the prior art references that are combined must teach or suggest all of the claim limitations. In re Vaeck, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991).

Claim 1 is to a method of cleaning a surface of a substrate processing chamber component to remove process deposits on the component. The method

comprises heating the surface comprising the process deposits to a temperature of at least about 150°C; and cooling the chamber component surface comprising the process deposits to a temperature below about -40°C by at least one of (i) immersing the surface in liquid nitrogen, and (ii) spraying the surface with liquid nitrogen, thereby fracturing the process deposits on the surface.

As acknowledged by the Examiner, "Sasaki et al. fails to disclose immersing the surface in liquid nitrogen or spraying the surface with the liquid nitrogen or grit blasting or heating the surface after cooling or a texture surface." Sasaki et al. also fail to disclose heating the surface comprising the process deposits to a temperature of at least about 150°C as claimed.

The combination of Sasaki et al. and Braton et al. fails to establish a *prima facie* obviousness rejection. First, Braton et al. is non-analogous art and it is not obvious to remedy the deficiencies of Sasaki et al. with non-analogous art taught by Braton et al. as there is no reasonable expectation of success that the result of such a combination would be an operable invention. Two criteria have evolved for determining whether prior art is analogous: (1) whether the art is from the same field of endeavor, and (2) if the reference is not within the field of the inventor's endeavor, whether the reference still is reasonably pertinent to the particular problem with which the inventor is involved.

Braton et al. is not from the same field of endeavor as the present invention, namely fabrication of substrate such as semiconductor wafers and displays. Further, according to the Examiner own statement, the Braton et al. "reference fails to clean a surface of a substrate processing chamber component."

Braton et al. is also not reasonably pertinent to the particular problem solved by the present invention, namely cleaning process deposits from substrate processing chamber components which are very sensitive to contamination. A reference is reasonably pertinent if it is one which, because of the matter with which it deals,

logically would have commended itself to the inventor's attention in considering his problem. If a reference disclosure has the same purpose as the claimed invention, the reference relates to the same problem, however, if it is directed to a different purpose, the inventor would have accordingly have had less motivation or occasion to consider it. In re Clay, 23 USPQ 2d 1058, 1060-61 (Fed. Cir. 1992). Braton et al. teaches a bulk and heavy industrial process to remove organic residues that build up in the application of surface finishes or surface treatments to parts. (Col. 1, lines 11-25). One of ordinary skill in the art of semiconductor fabrication would not consider an industrial cleaning process because the of the vastly different requirements in the standard of cleanliness. Accordingly, the Broderick et al. reference is non-analogous art, should not be applied in this rejection, and is not reasonably pertinent because it would not have logically commended itself to the inventor's attention in considering his problem.

Furthermore, there is no teaching that suggests the desirability of combining Sasaki et al. and Braton et al.. To establish a prima facie case of obviousness, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to combine the reference teachings, and there must also be a reasonable expectation of success for such a combination. In re Vaeck, 947 F.2d 488 (Fed. Cir. 1991). There is no suggestion in Braton et al. to apply the process described in Braton et al. to remove process residues from a pipe in a semiconductor device fabricating machine to the process taught by Sasaki et al. or vice versa. Braton et al. teaches a non-analogous process in a heavy industry "... for removal of layers of organic material built up on a support for articles during surface coating and treating comprising applying a liquefied inert gas to the support..." (Braton et al., Abstract.) There is no motivation to apply an industrial cleaning process as described by Braton et al. to a ultra clean semiconductor apparatus as taught by Sasaki et al..

The combination of Sasaki et al. and Braton et al, is further flawed because Sasaki et al. teaches away from the current invention. A reference will teach away if it suggests that the line of development flowing from the reference's disclosure

is unlikely to be productive of the result sought by the applicant. In re Gurley, 31 USPQ 2d 1130, 1131 (Fed. Cir. 1994). Sasaki et al. teaches away from the present claims, because Sasaki et al. teaches that:

> If the pipe of the semiconductor device fabricating machine is heated while supplying the pipe with a cleaning gas composed by adding 1% to 5% of $O_2$ into a high-purity Ar, as shown in FIG. 1, an organic matter 2 adhered to an inner wall surface 1 of the pipe is continuously hit by Ar molecules 3, with the result that the organic matter 2 is blown off. (Sasaki et al., Col. 4, lines 29-35.)

Thus Sasaki et al. teaches flowing gas through a pipe of a substrate fabrication machine to blow and dislodge organic matter from the inner surface of the pipe and flush it out of the machine while leaving the pipe assembled in place in the machine. In Sasaki et al.'s method, the pipe remains in the semiconductor fabrication machine and a gas is flowed through the pipe to clean the inside of the pipe. However, flowing a cleaning gas through and/or over components in a substrate fabrication machine, such as a chamber, would flake off deposits from the component surfaces throughout the machine, and cause these flaked off deposits to redeposit in, and contaminate, the machine. The object of cleaning a the semiconductor apparatus would not be met if the cleaning process created worse contamination of the machine instead of cleaning it, thus, Sasaki et al.'s process teaches away from the present claims.

Further, neither Braton et al. or Sasaki et al. teach or suggest heating the surface comprising the process deposits to a temperature of at least about 150°C, as recited in amended claim 1 prior to cooling the same surface to -40°C. It is non-obvious to heat the surface to at least 150°C prior to cooling it to -40°C as claimed. The heating and cooling processes are inapposite to one another. Applicant has discovered that heating the component surface to a temperature of at least about 150°C before cooling the same surface to temperature of -40°C, as recited in claim 1, thermally shocks the component surface to cause process deposits to efficiently flake off. It is non-obvious to heat the surface prior to cooling it to the claimed temperature levels to achieve sufficiently high levels of thermal shock to entirely remove process residues from the surface without damaging the component or surface.

For these reasons, the combination of Sasaki et al. and Braton et al. do not teach or suggest the method of claim 1. Thus, claim 1 and the claims depending therefrom, are patentable over Sasaki et al. in view of Barton et al..

2. The Examiner rejected claim 5 under 35 U.S.C. § 103(a) as being unpatentable over Sasaki et al. in view of Barton et al. as applied to claim 1, and further in view of Sakurai et al. (U.S. Patent No. 6,082,373).

Claim 5 is dependent on independent claim 1 and is therefore patentable over Sasaki et al. in view of Barton et al. for the same reasons as explained above.

Sakurai et al. does not make up for the deficiencies of Sasaki et al. or Barton et al. because Sakurai et al. also does not teach heating the surface comprising the process deposits to a temperature of at least about 150°C; and thereafter, applying liquid nitrogen to the component by immersion or spraying to cool the component to reach low temperatures of below about - 40°C, to fracture process deposits on the component surface as claimed in claim 1. Instead Sakurai et al. teaches a cleaning process in which oxygen is dissolved in aerated water and the component is contacted with the water while ultrasonic vibrations are applied. (Abstract.) Sakurai et al. further teaches that:

> It is preferred that the amount of oxygen dissolved into the pure water is 0.5 ppm or more. According to the oxygen dissolving methods (1) and (2), oxygen can be dissolved into pure water up to about 20 ppm at 25° C.(Sasaki et al., Col. 3, lines 16-19.)

Thus, Sakurai et al. teaches a cleaning process in which the component is maintained at temperatures of 25°C in aerated water. Sakurai et al. does not teach the claimed process of heating and then immersing the component or spraying liquid nitrogen onto the surface of the component to cool the surface to low temperatures of -40°C, thereby fracturing the process deposits on the surface.

Thus, one of ordinary skill in the art would not have a reasonable expectation of success, or motivation, to combine the processes taught by Sasaki et al., Barton et al., or Sakurai et al. to derive the claimed process of heating the surface comprising the process deposits to a temperature of at least about 150°C; and immersing the component in liquid nitrogen or spraying liquid nitrogen onto a component, to cool the component surface to low temperatures of below about -40°C, thereby causing process deposits to fracture and flake off from the component surface.

Thus, Applicant respectfully submits that claim 5 is patentable over the cited combination of Sasaki et al., Barton et al. and Sakurai et. al..

3. The Examiner rejected claims 6 and 7-8 under 35 U.S.C. §103(a) as being unpatentable over Sasaki et al. in view of Klee et al. (U.S. Patent No. 4,627,197).

Claims 6 and 7-8 are all dependent on claim 1. As explained above, Sasaki does not teach a method of cleaning a surface of a component to remove process deposits, comprising heating the surface comprising the process deposits to a temperature of at least about 150°C; and cooling the surface of the component to a temperature below about -40°C by immersing the surface in liquid nitrogen or spraying the surface with liquid nitrogen, thereby fracturing the process deposits on the surface of the component, as in claim 1.

Sasaki et al. teaches applying nitrogen gas into a pipe so that the nitrogen gas blows off the contaminant residues from the pipe sidewalls. Sasaki et al. does not teach heating the surface comprising the process deposits to a temperature of at least about 150°C; and immersing the component in a fluid or spraying a component with a fluid to reach low temperatures of - 40°C, as claimed in claim 1, to cause process residues to fracture and flake off from the component surface instead of being blown off by nitrogen gas.

Klee et al. does not make up for the deficiencies of Sasaki et al. because Klee et al. is non-analogous art. Klee et al. teaches removing flash from molded articles and paint and other coatings. (Col. 1, lines 10-15.) Klee et al. is non-analogous art as the reference is not within the endeavor of the Applicant's invention, namely the art of semiconductor fabrication. Removing flash molding is an industrial factory process performed in an environment with much lower cleanliness standards than the requisite clean room environment of a semiconductor fabrication floor. One of ordinary skill would not seek knowledge from industrial factory processes to apply to semiconductor and display fabrication processes. Thus, Klee et al. should not be applied in this rejection as Klee et al. is non-analogous art.

Furthermore, for such a combination there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to combine the teachings of the different references. There is no suggestion in Klee et al. to apply the process described to remove process residues in semiconductor fabrication. Similarly, there is not suggestion in Sasaki et al. to apply its described processes to the industrial arts described by Klee et al. Further, there is no motivation to combine the teachings of Klee et al. and Sasaki et al. to achieve a process which comprises heating the surface comprising the process deposits to a temperature of at least about 150°C (or 300°C as recited in amended claim 7), and thereafter, immersing the component in a fluid or spraying a component with a fluid to reach low temperatures of - 40°C.

For these reasons, Applicant respectfully submits that claims 6-8 are not obvious over the combination of Sasaki et al. and Klee et al..

4. The Examiner rejected claim 11 under 35 U.S.C. § 103(a) as being unpatentable over Sasaki et al. in view of Hatano (U.S. Patent No. 5,954,887).

Claim 11 is dependent on independent claim 1 which is patentable over Sasaki et al. for the reasons explained above. However, Hatano fails to make up for the deficiencies of Sasaki et al. because Hatano also does not teach a method of cleaning a surface of a substrate processing chamber component to remove process deposits, comprising heating the surface comprising the process deposits to a temperature of at least about 150°C; and immersing the component in a fluid or spraying a component with a fluid to reach low temperatures of - 40°C, as claimed in claim 1. Instead, Hatano teaches a cleaning process in which "...$TiCl_4$ gas is introduced by means of a carrier gas, to remove unnecessary Ti films sticking to the inside of the film forming apparatus." (Hatano, Abstract.) Thus, Hatano does not teach the claimed process of immersing a component surface in liquid nitrogen or spraying liquid nitrogen onto the component to cool the component surface to low temperatures of below about -40°C, thereby causing residue material to fracture and flake off from the component surface.

Sasaki et al. teaches applying nitrogen gas into a pipe so that the nitrogen gas blows off the contaminant residues from the pipe sidewalls while they are subject to thermal stresses and Hatano teaches a cleaning process in which a $TiCl_4$ gas is supplied to a chamber. One of ordinary skill in the art would not have a reasonable expectation of success to employ the process taught by Sasaki et al. or Hatano to derive the claimed process of immersing a component in liquid nitrogen or spraying liquid nitrogen onto the surface to the component, to cool the component surface to low temperatures of below about -40°C, thereby causing residue material to fracture and flake off from the component surface.

For these reasons, Applicant respectfully submits that claim 11 is patentable over the cited combination of Sasaki et al. and Hatano.

5. Added Claims 36 to 45

Added claims 36 to 45 are novel and non-obvious over the cited art for the same reasons as claim 1, as explained above, namely the cited references do not teach heating the surface comprising the process deposits to a temperature of at least about 150°C; and cooling the surface to a temperature below about -40°C by (i) immersing the surface in liquid nitrogen, or (ii) spraying the surface with the liquid nitrogen, thereby fracturing the process deposits on the surface.

In addition, claim 36 further recites cooling the surface comprising the process deposits at a cooling rate of at least about 50°C per second. This "shock cooling" step provides a high cooling rate to enhance fracturing and cracking of process deposits from the component surface by rapid cooling and contraction of the surface, as explained in the Specification.

The above-discussed amendments are believed to place the present application in condition for allowance. Should the Examiner have any questions regarding the above remarks, the Examiner is requested to telephone Applicant's representative at the number listed below.

Respectfully submitted,
**JANAH & ASSOCIATES, P.C.**

Date: January 11, 2007

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